PYRAMID GEOPHYSICAL SERVICES
(PROJECT 2017-253)

GEOPHYSICAL SURVEY

METALLIC UST INVESTIGATION:
PARCEL 5
NCDOT PROJECT P-5705B (44475.1.2)

601 W. TRADE ST., CHARLOTTE, NC

SEPTEMBER 20, 2017

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GEOPHYSICAL INVESTIGATION REPORT
Parcel 5 – 601 W. Trade St.
Charlotte, Mecklenburg County, North Carolina

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LIST OF ACRONYMS

CADD .....Computer Assisted Drafting and Design
DF .....Dual Frequency
EM.....Electromagnetic
GPR.....Ground Penetrating Radar
GPS .....Global Positioning System
NCDOT.....North Carolina Department of Transportation
ROW .....Right-of-Way
UST .....Underground Storage Tank

EXECUTIVE SUMMARY

Project Description: Pyramid Environmental conducted a geophysical investigation for the North Carolina Department of Transportation (NCDOT) at Parcel 5, located at 601 W. Trade St., Charlotte, NC. The survey was part of an NCDOT Right-of-Way (ROW) investigation (NCDOT Project P-5705B). The survey was designed to include all accessible portions of the parcel. Conducted on August 18, 2017, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area. One known UST was documented to be present at the site.

Geophysical Results: The geophysical investigation consisted of electromagnetic (EM) induction-metal detection and ground penetrating radar (GPR) surveys. A total of twelve EM anomalies were identified. The majority of the EM anomalies were associated with visible cultural features. The known UST location, as well as areas suspected to contain metal reinforcement, a buried utility, and areas inaccessible to the EM instrument were investigated further by GPR. GPR verified the extents of the known UST under the concrete pad in the parking area (center point: 1447965, 544149; North Carolina State Plane NAD83, feet). The known UST was approximately 21 feet long and 10 feet wide, at a depth of approximately 2.5 feet below the ground surface.

The remaining GPR transects verified areas containing reinforced concrete and buried utilities across the site, and further investigated areas inaccessible to the EM instrument. No evidence of additional USTs was observed.

Collectively, the geophysical data recorded evidence of one known metallic UST at Parcel 5.

INTRODUCTION

Pyramid Environmental conducted a geophysical investigation for the North Carolina Department of Transportation (NCDOT) at Parcel 5, located at 601 W. Trade St., Charlotte, NC. The survey was part of an NCDOT Right-of-Way (ROW) investigation (NCDOT Project P-5705B). The survey was designed to include all accessible portions of the parcel. Conducted on August 18, 2017, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area. One known UST was documented to be present at the site.

The site included a commercial bus depot surrounded by asphalt parking areas. The location of the known UST was evidenced by a concrete pad and fill ports. It should be noted that large portions of the site were inaccessible due to parked vehicles, which also resulted in widespread metallic interference during the EM survey (see Discussion of Results below). An aerial photograph showing the survey area boundaries and ground-level photographs are shown in **Figure 1**.

FIELD METHODOLOGY

The geophysical investigation consisted of electromagnetic (EM) induction-metal detection and ground penetrating radar (GPR) surveys. Pyramid collected the EM data using a Geonics EM61 metal detector integrated with a Trimble AG-114 GPS antenna. The integrated GPS system allows the location of the instrument to be recorded in real-time during data collection, resulting in an EM data set that is geo-referenced and can be overlain on aerial photographs and CADD drawings. A boundary grid was established around the perimeter of the site with marks every 10 feet to maintain orientation of the instrument throughout the survey and assure complete coverage of the area.

According to the instrument specifications, the EM61 can detect a metal drum down to a maximum depth of approximately 8 feet. Smaller objects (1-foot or less in size) can be detected to a maximum depth of 4 to 5 feet. The EM61 data were digitally collected at

approximately 0.8-foot intervals along north-south trending or east-west trending, generally parallel survey lines, spaced five feet apart. The data were downloaded to a computer and reviewed in the field and office using the Geonics NAV61 and Surfer for Windows Version 14.0 software programs.

GPR data were acquired across select EM anomalies on August 18, 2017, using a Geophysical Survey Systems, Inc. (GSSI) UtilityScan DF unit equipped with a dual frequency 300/800 MHz antenna. Data were collected both in reconnaissance fashion as well as along formal transect lines across EM features. The GPR data were viewed in real-time using a vertical scan of 512 samples, at a rate of 48 scans per second. GPR data were viewed down to a maximum depth of approximately 6 feet, based on dielectric constants calculated by the DF unit in the field during the reconnaissance scans. GPR transects across specific anomalies were saved to the hard drive of the DF unit for post-processing and figure generation.

Pyramid's classifications of USTs for the purposes of this report are based directly on the geophysical UST ratings provided by the NCDOT. These ratings are as follows:

Geophysical Surveys for Underground Storage Tanks
on NCDOT Projects

High Confidence	Intermediate Confidence	Low Confidence	No Confidence
Known UST Active tank - spatial location, orientation, and approximate depth determined by geophysics.	**Probable UST** Sufficient geophysical data from both magnetic and radar surveys that is characteristic of a tank. Interpretation may be supported by physical evidence such as fill/vent pipe, metal cover plate, asphalt/concrete patch, etc.	**Possible UST** Sufficient geophysical data from either magnetic or radar surveys that is characteristic of a tank. Additional data is not sufficient enough to confirm or deny the presence of a UST.	Anomaly noted but not characteristic of a UST. Should be noted in the text and may be called out in the figures at the geophysicist's discretion.

DISCUSSION OF RESULTS

Discussion of EM Results

A contour plot of the EM61 results obtained across the survey area at the property is presented in **Figure 2**. Each EM anomaly is numbered for reference in the figure. The

following table presents the list of EM anomalies and the cause of the metallic response, if known:

LIST OF METALLIC ANOMALIES IDENTIFIED BY EM SURVEY

Metallic Anomaly #	Cause of Anomaly	Investigated with GPR
1	Reinforced concrete	☑
2	Drainage pipe	☑
3	Vehicle	
4	Chain link fence	
5	**One Known UST**	☑
6	Reinforced concrete	☑
7	Bus	☑
8	Vehicle	
9	Dumpsters	☑
10	Utility vault	
11	Vehicles throughout parking area	☑
11	Buses	

The majority of the EM anomalies were the result of known cultural features including reinforced concrete, a drainage pipe, abundant vehicles and buses, a chain link fence, dumpsters, and a utility vault. Anomaly 5 was associated with the known UST. GPR was performed to verify the extents of the known UST, as well as to examine areas suspected to contain reinforced concrete and to verify the drainage pipe location (Anomaly 2). Additionally, GPR was performed in accessible areas between vehicles where EM data were not collected.

Discussion of GPR Results

Figure 3 presents the locations of the formal GPR transects performed at the property, as well as select transect images. All of the transect images are included in **Appendix A**. A total of nine GPR transects were performed at the site. GPR Transects 1, 4 and 7 were all performed across areas suspected to contain metal-reinforced concrete. These transects verified the presence of reinforcement, and did not record any evidence of larger structures such as USTs underlying the reinforcement.

GPR Transect 2 verified the presence of a buried storm drain pipe crossing through the parking lot (Anomaly 2). GPR Transect 3 was performed across the width of the known UST, verifying that this tank was contained within the observed concrete pad in the parking area. The known UST was approximately 21 feet long and 10 feet wide at a depth of approximately 2.5 feet below the ground surface (center point of tank: 1447965, 544149; North Carolina State Plane NAD83, feet).

GPR Transects 5, 6, 8 and 9 were all performed across areas where EM data collection access was limited, which resulted in metallic interference, due to buses and vehicles. No evidence of any structures such as USTs was observed in these GPR transects.

Collectively, the geophysical data recorded evidence of one known metallic UST at Parcel 5.

Figure 4 presents the location of the known UST along with a ground-level photograph. **Figure 5** provides an overlay of the geophysical survey areas and the known UST onto the NCDOT MicroStation engineering plans for reference.

SUMMARY & CONCLUSIONS

Pyramid's evaluation of the EM61 and GPR data collected at Parcel 5 in Charlotte, North Carolina, provides the following summary and conclusions:

- The EM61 and GPR surveys provided reliable results for the detection of metallic USTs within the accessible portions of the geophysical survey area.
- The majority of the EM anomalies were associated with visible cultural features. The known UST location, as well as areas suspected to contain metal reinforcement, a buried utility, and areas inaccessible to the EM instrument were investigated further by GPR.
- GPR verified the extents of the known UST under the concrete pad in the parking area (center point: 1447965, 544149; North Carolina State Plane NAD83, feet).

- The known UST was approximately 21 feet long and 10 feet wide, at a depth of approximately 2.5 feet below the ground surface.
- The remaining GPR transects verified areas containing reinforced concrete and buried utilities across the site, and further investigated areas inaccessible to the EM instrument. No evidence of additional USTs was observed.
- Collectively, the geophysical data recorded evidence of one known metallic UST at Parcel 5.

LIMITATIONS

Geophysical surveys have been performed and this report was prepared for the NCDOT in accordance with generally accepted guidelines for EM61 and GPR surveys. It is generally recognized that the results of the EM61 and GPR surveys are non-unique and may not represent actual subsurface conditions. The EM61 and GPR results obtained for this project have not conclusively determined the definitive presence or absence of metallic USTs, but the evidence collected is sufficient to result in the conclusions made in this report. Additionally, it should be understood that areas containing extensive vegetation, reinforced concrete, or other restrictions to the accessibility of the geophysical instruments could not be fully investigated.

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APPROXIMATE BOUNDARIES OF GEOPHYSICAL SURVEY AREA

View of Survey Area
(Facing Approximately Southwest)

View of Survey Area
(Facing Approximately Northwest)

TITLE
PARCEL 5 - GEOPHYSICAL SURVEY
BOUNDARIES AND SITE PHOTOGRAPHS

PROJECT
PARCEL 5
NCDOT PROJECT P-5705B (WBS 44475.1.2)
CHARLOTTE, NORTH CAROLINA

PYRAMID GEOPHYSICS
503 INDUSTRIAL AVENUE
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License # C1251 Eng. / License # C257 Geology

DATE 9/13/2017	CLIENT NCDOT
PYRAMID PROJECT #: 2017-253	**FIGURE 1**

N

EM61 METAL DETECTION RESULTS

EVIDENCE OF ONE KNOWN METALLIC UST OBSERVED.

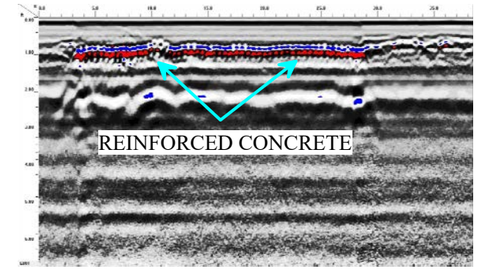
The contour plot shows the differential results of the EM61 instrument in millivolts (mV). The differential results focus on larger metallic objects such as USTs and drums. The EM61 data were collected on August 18, 2017, using a Geonics EM61 instrument. Verification GPR data were collected on August 18, 2017, using a GSSI UtilityScan DF unit with a dual frequency 300/800 MHz antenna.

EM61 Metal Detection Response (millivolts)

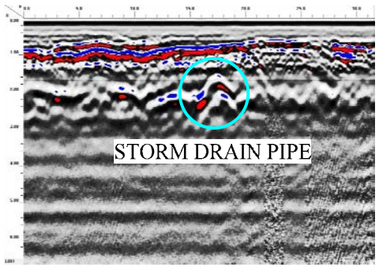
TITLE	PARCEL 5 - EM61 RESULTS CONTOUR MAP
PROJECT	PARCEL 5 NCDOT PROJECT P-5705B (WBS 44475.1.2) CHARLOTTE, NORTH CAROLINA
PYRAMID GEOPHYSICS	503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology
DATE 9/13/2017	CLIENT NCDOT
PYRAMID PROJECT #: 2017-253	**FIGURE 2**

N

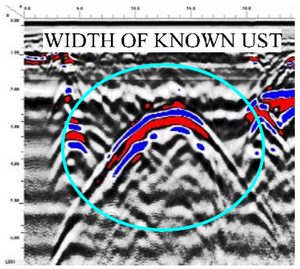
GPR TRANSECT LOCATIONS



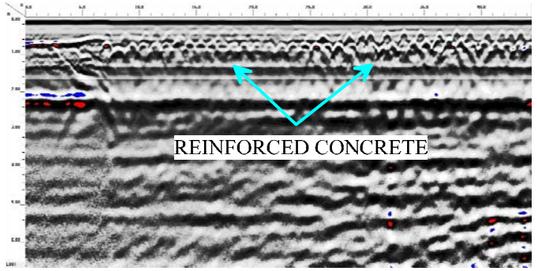
GPR TRANSECT 1 (T1)



GPR TRANSECT 2 (T2)



GPR TRANSECT 3 (T3)



GPR TRANSECT 7 (T7)

TITLE	PARCEL 5 - GPR TRANSECT LOCATIONS AND SELECT IMAGES
PROJECT	PARCEL 5 NCDOT PROJECT P-5705B (WBS 44475.1.2) CHARLOTTE, NORTH CAROLINA
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DATE: 9/13/2017	CLIENT: NCDOT
PYRAMID PROJECT #: 2017-253	**FIGURE 3**

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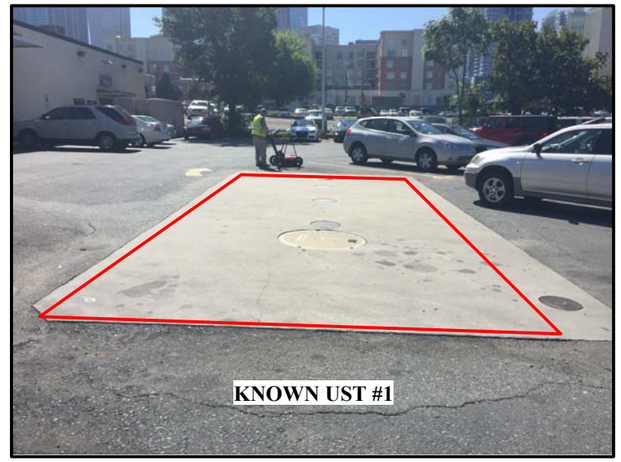
LOCATION OF KNOWN UST



View of Known UST #1
Facing Approximately Southeast

TITLE	PARCEL 5 - LOCATION AND SIZE OF KNOWN UST
PROJECT	PARCEL 5 NCDOT PROJECT P-5705B (WBS 44475.1.2) CHARLOTTE, NORTH CAROLINA
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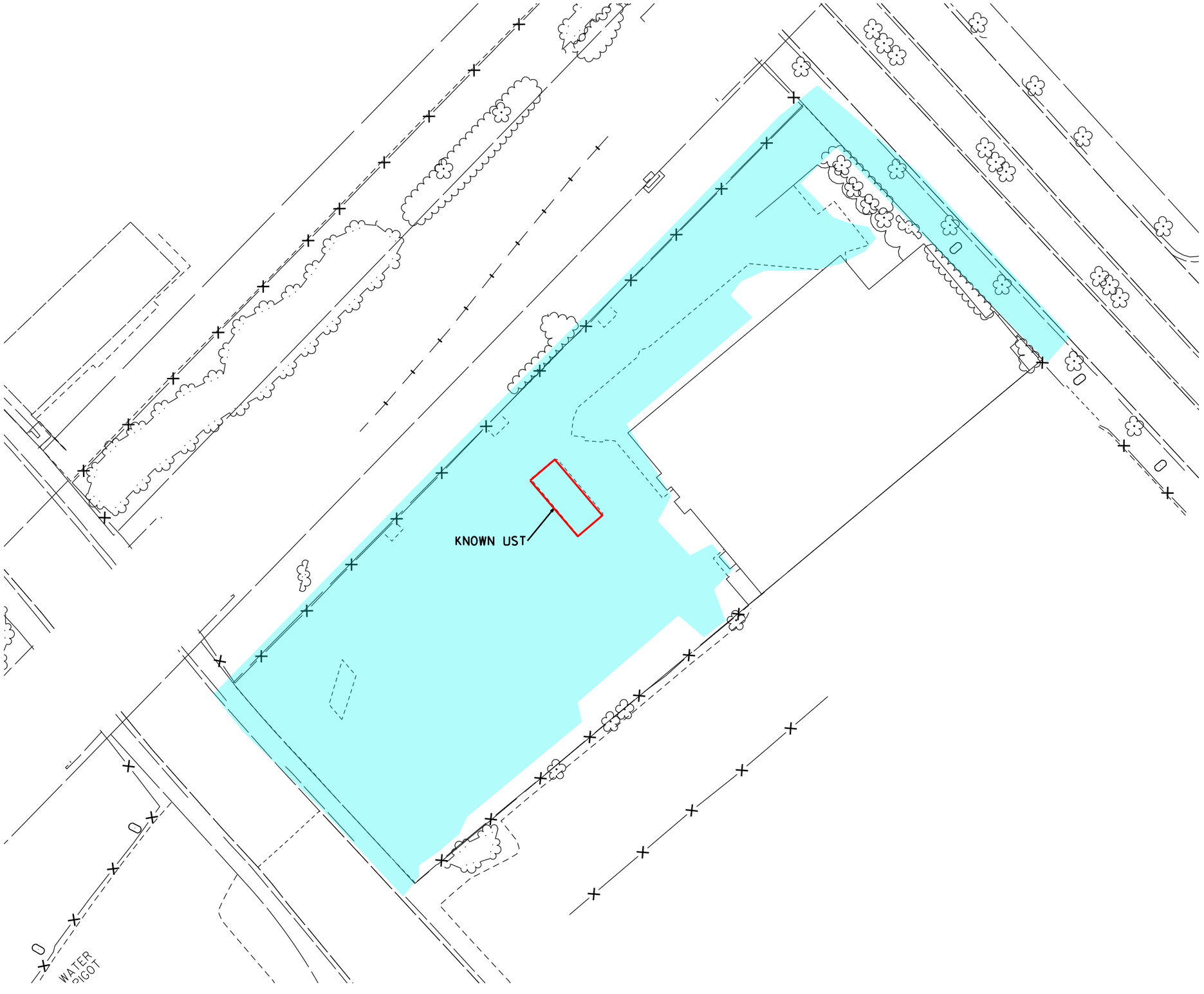
DATE: 9/13/2017	CLIENT: NCDOT
PYRAMID PROJECT #: 2017-253	**FIGURE 4**



LEGEND

EXISTING ROW

EXISTING PROPERTY BOUNDARY

GEOPHYSICAL SURVEY AREA

KNOWN METALLIC UST

0 25 50
FEET

N

TITLE
OVERLAY OF SURVEY BOUNDARIES
AND KNOWN METALLIC UST
ON NCDOT ENGINEERING PLANS

PROJECT
PARCEL 5
NCDOT PROJECT P-5705B
CHARLOTTE, NORTH CAROLINA

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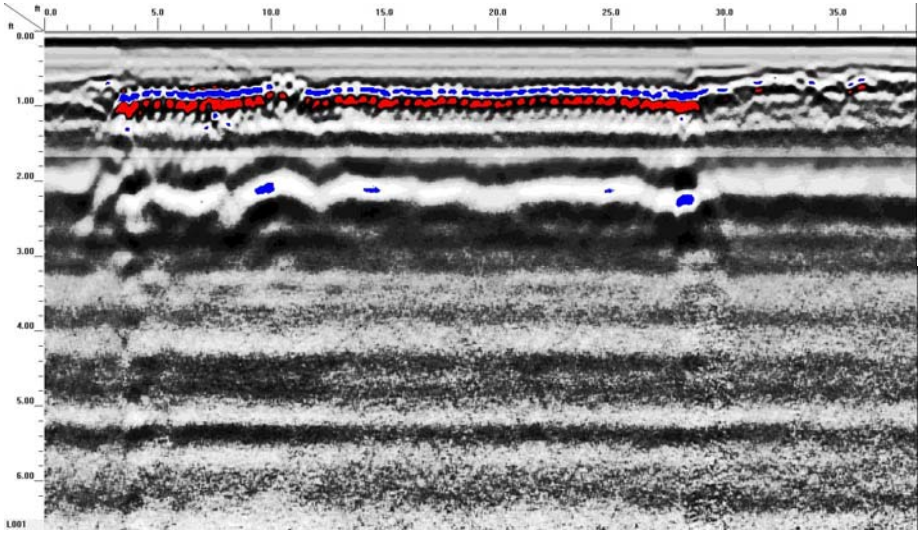
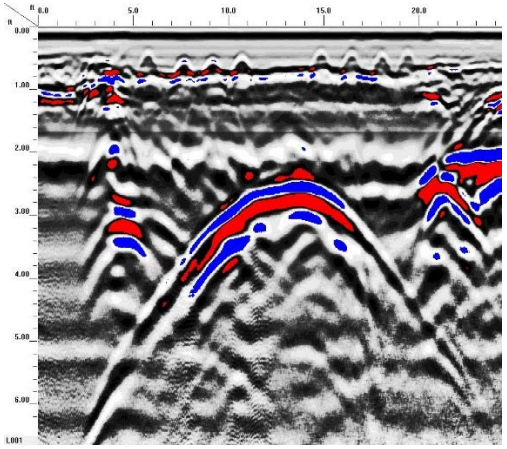
DATE: 9-13-17	REVISION NO. 0
PYRAMID PROJECT NO. 2017-253	FIGURE NO. 5

Appendix A – GPR Transect Images



GPR TRANSECT 1



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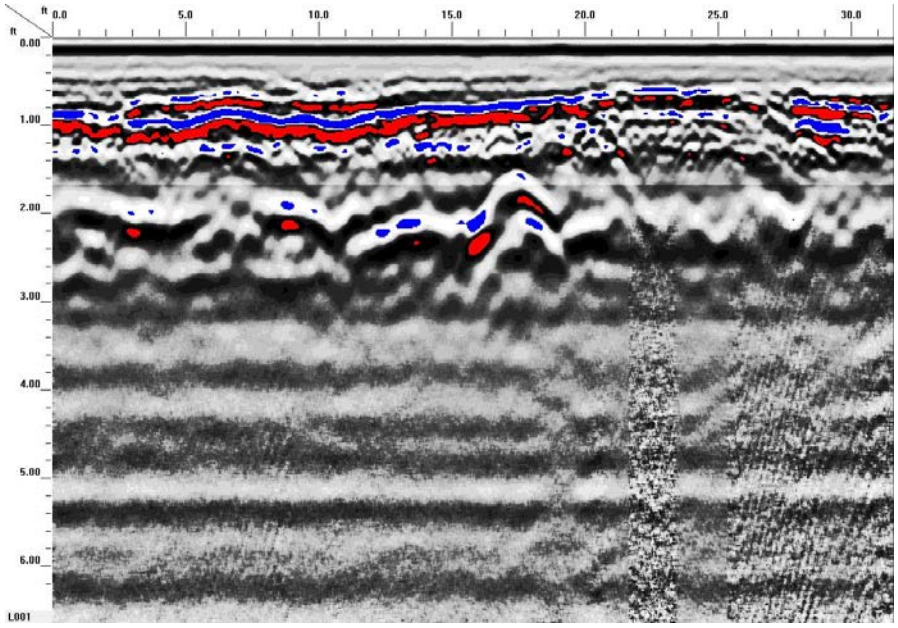

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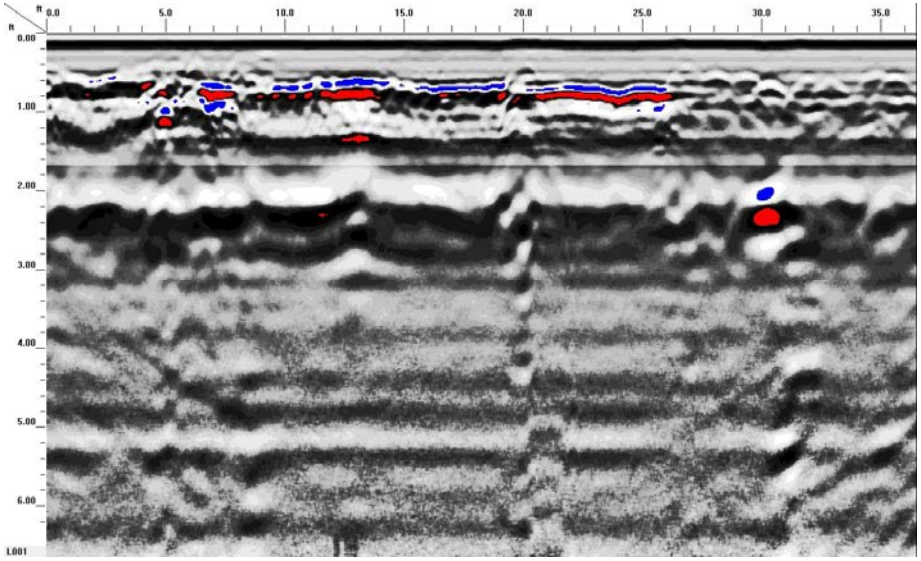

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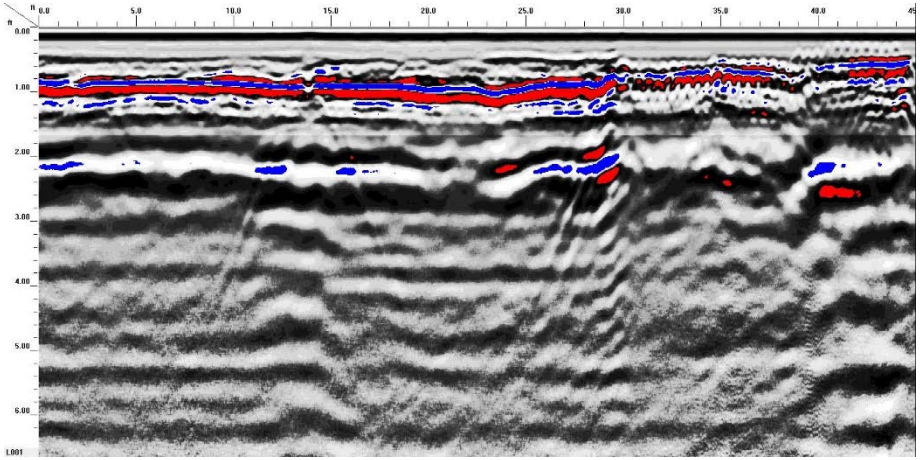

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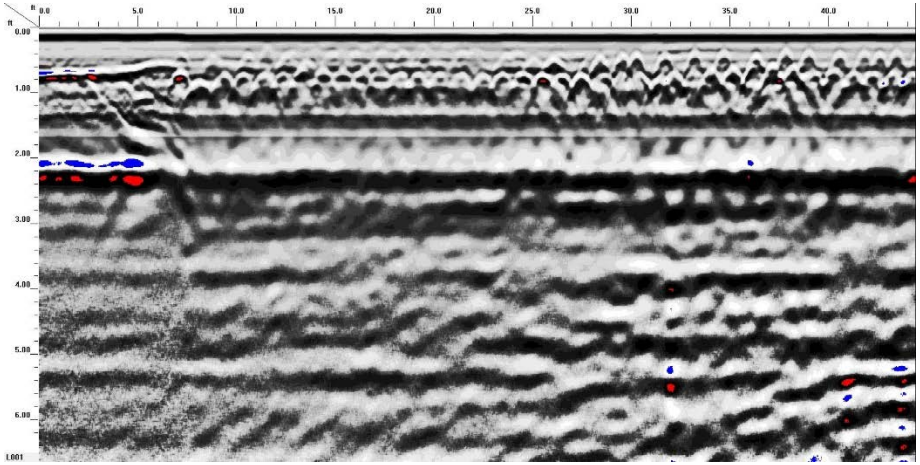
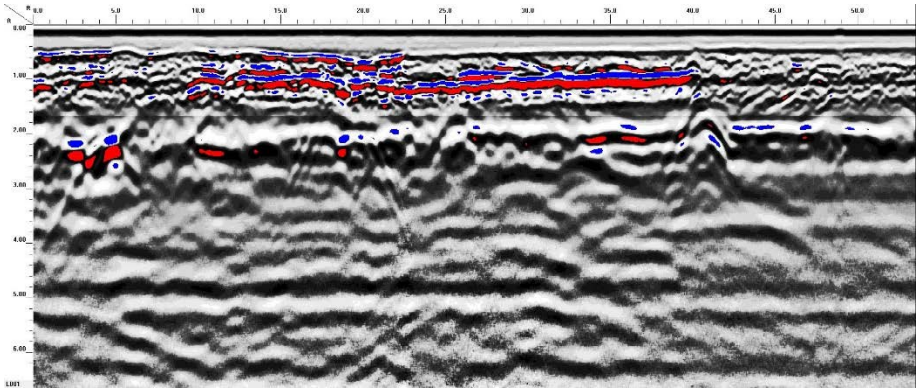
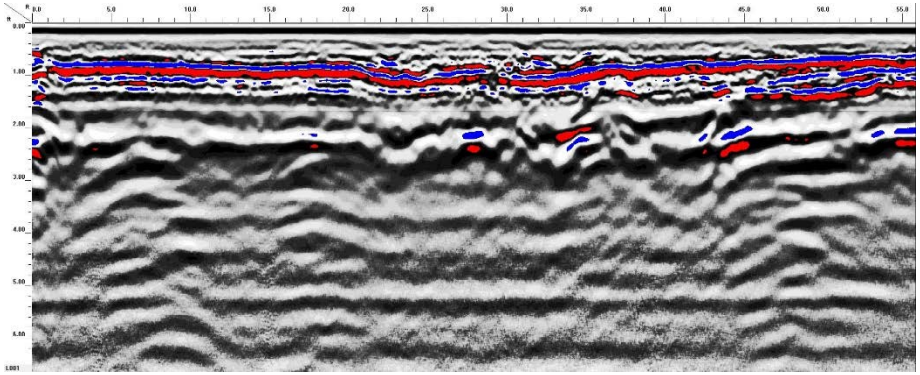


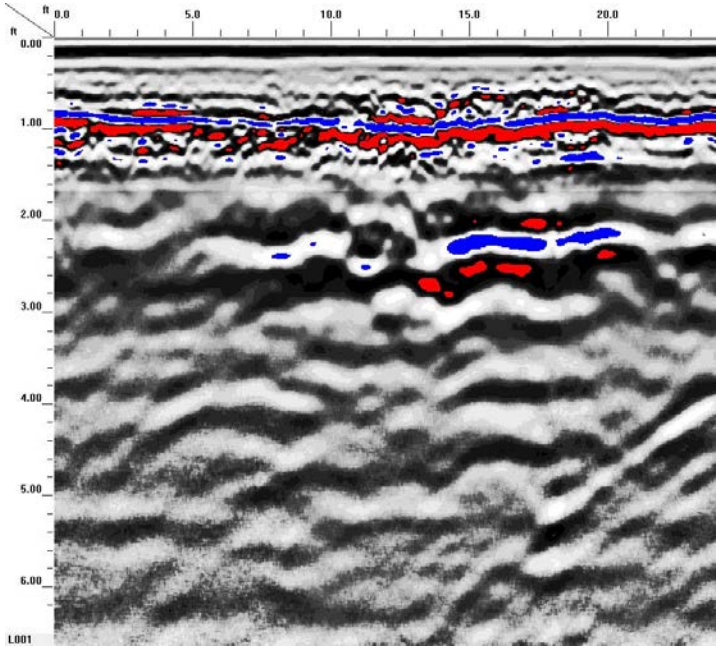
GPR TRANSECT 7



GPR TRANSECT 6



GPR TRANSECT 8



GPR TRANSECT 9